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PREPARATIONS

/9835

UDC 621.762:669.27'849

Structure and Mechanical Properties of Deformed W-Re Powder Alloys

18420020 Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, Aug 87
(manuscript received 17 Jun 86) pp 88-92

[Article by Yu. N. Podrezov, O. G. Radchenko, N. G. Danilenko, V. V. Panichkina, V. I. Gachegov and A. B. Olshanskiy, Institute of Materials Science, UkSSR Academy of Sciences]

[Abstract] An experimental study of sintered W + 2% Re alloy and of this alloy with (Y_2O_3, Hf_2O_3) admixture, as well as of commercially pure W, was made for a comparative evaluation of their structural and mechanical characteristics after 80% deformation by rolling. Specimens were cut in four ways: parallel or perpendicularly to the direction of rolling and in each case along either of the two principal orthogonal transverse planes. They were all annealed for 2 h at 1800°C, within the temperature range of complete selective recrystallization. They were then tested in flexure by the three-point method for the temperature dependence of flexural yield strength and ultimate strength, maximum deflection, and viscoelastic transition point over the -60-(+60)°C range, the highest temperature at which bending through a 90° angle without fracture was possible being regarded as viscoelastic transition point. Microstructural examination was done by the fractographic method under a T-20 scanning electron microscope. The results indicate that the characteristics of the sintered W + 2% Re alloy after deformation are slightly better than those of the sintered W + 2% Re + (Y_2O_3, Hf_2O_3) alloy and much better than those of sintered plain tungsten and also better than those of the cast W + 2% Re alloy, after deformation. References 6: 5 Russian, 1 Western (in Russian translation).

2415/9835

UDC 669.15'25'26:538.22

Study of Fe-Co-Cr Permanent-Magnet Alloys With Varying Co Content by Methods of Nuclear-Magnetic Resonance and Nuclear-Gamma Resonance

18420019d Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 64, No 2, Aug 87 (manuscript received 20 Jan 86) pp 333-337

[Article by V. V. Serikov, N. M. Kleynerman, Ye. V. Belozerov, Ye. Ye. Yurchikov, T. P. Lapina and Ya. S. Shur, Metal Physics Institute, Ural Depratment, USSR Academy of Sciences]

[Abstract] An experimental study of Fe-Co-Cr alloys with 5-29% Co heat treated for optimization of their magnetic properties was made, its purpose being to determine the dependence of their characteristics on the Co content. Five alloys with 45-65% Fe + 5-25% Co + 30% Cr and one alloy with 55% Fe + 20% Co + 25% Cr were produced from pure ingredients in an induction furnace. Ingots were hot rolled and then cold rolled to 0.3 mm thick foils. Ribbons cut in the direction of rolling were quenched from 1300°C in water and then treated in a slat bath for 1 h at 640°C + 1 h at 600°C + 1 h at 580°C + 4 h at 560°C + 6 h at 540°C. They were subsequently ground with diamond paste and electrolytically polished for measurement of magnetic properties by the ballistic method. Their structure was examined by the method of nuclear-magnetic resonance involving measuring of hyperfine fields on ^{57}Fe nuclei with a spin-echo spectrometer at a temperature of 77 K and by the method of nuclear-gamma resonance involving measurement of hyperfine fields on ^{59}Co nuclei in a Cr matrix with a YaGRS-4M spectrometer at a temperature of 300 K. Phase analysis was done in an RKU-114 camera with Cr-line and Mo-line raidation sources. Both coercive force and degree of anisotropy were found to decrease with decreasing Co content and attendant weakening of not only the ferromagnetic sextet line with a 28.5 kA/m strong hyperfine field but also the singlet line. An evaluation of the data, based on the model of a ferromagnetic sponge and each ferromagnetic phase consisting of an ordered kernel inside a disordered shell, indicates that with a decrease of the Co content the volume fraction of the ordered component also decreases. References 10: 5 Russian, 5 Western.

2415/9835

UDC 669.15'25'3'859'296:538.22

Dependence of Structure and Magnetic Properties of Sm-Co-Fe-Cu-Zr Alloys on Fe Content

18420019b Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 64, No 2, Aug 87 (manuscript received 20 May 86) pp 300-307

[Article by A. G. Popov, G. V. Ivanova, V. S. Gaviko, L. M. Magat, V. G. Maykov and Ya. S. Shur, Metal Physics Institute, Ural Department, USSR Academy of Sciences]

[Abstract] An experimental study of $Sm(Co_{0.90-v}Fe_vCu_{0.078}Zr_{0.022})_{7.3}$ alloys was made for a determination of their magnetic properties and structural

characteristics depending on the Fe content v, substitution of Fe for Co already being known to increase the energy product of all $Sm(CoFeCuZr)_z$ magnetic alloys and their coercive force known to depend not only on the Fe content but also on the homogenization annealing temperature. Alloys with v = 0.10-0.30 Fe were produced by casting and by sintering of powder. After heat treatment, spherical pseudosingle-crystal specimens of cast alloys were tested in a vibromagnetometer and prismatic specimens of powder alloys were tested in a "Permagraph" magnetometer. Phase analysis by the rotation method was done in an RKU-114M x-ray camera with a FeK_α-radiation; phase analysis by the powder method was done in a DRON-UM1 x-ray diffractometer with a FeK_α-radiation and a plane graphite monochromator. The results reveal that increasing the Fe content lowers the peritectic melting point, which requires lowering the heat treatment temperature so that complete homogenization along with maximum coercive force may not be attained. Powder alloys were found to homogenize much faster than cast ones, evidently because of their finer structure. The 1:5 phase plays a significant role. It contains Cu and precipitates at 850°C, its volume fraction decreasing as the Fe content increases so that less Cu is required for attainment of a high coercive force. Maximization of the coercive force by slow cooling through the 700-400°C range was found to be facilitated by Cu-enrichment and possibly Sm-enrichment of this 1:5 phase. References 13: 8 Russian, 5 Western.

2415/9835

UDC 539.213:533.35

Structure of Boron Films Produced by Laser-Chemical Reactions in Field of Pulsed CO_2-Laser

184200Ob Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 27 Aug 86) pp 73-76

[Article by P. D. Kervalishvili, E. R. Kuteliya and G. I. Tkeshelashvili, Tbilisi]

[Abstract] An experimental study of boron films was made, such films having semiconductor properties at high temperatures and therefore being eminently suitable for sensors in neutron dosimetry. Such films were produced from the organoboron compound $HClC{=}CHBCl_2$ in a special reactor chamber where radiation from a tunable CO_2-laser in approximately 100 ns wide pulses of 3 J energy dissociated it into BCl_3 and C_2H_2 fragments. The laser beam entered through optical windows, NaCl single crystals, on which boron films were deposited after elementary boron had been produced by a secondary chemical reaction. Specimens were then cut from these single crystals for electron-optical examination in a UEVM-100 K electron diffractometer with a DO-2 attachment and an "Opton" (FRG) EM-10 high-resolution electron microscope. Structural examination at an accelerating voltage of 75 kV revealed an amorphous boron film with crystalline inclusions. Further examination at an accelerating voltage of 100 kV revealed isosahedral clusters of boron atoms with the

short-range order of this amorphous phase close to that of the β-rhombohedral boron modification. Laser heating was found to stimulate first growth of amorphous boron particles, then crystallization of the amorphous phase, and subsequent growth of β-boron grains. References 5: all Russian.

2415/9835

UDC 621.033.67

Erosion of Materials in Plasma

18420005 Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 3 Apr 86) pp 46-48

[Article by P. Ya. Burchenko, Ye. D. Volkov, Yu. A. Gribanov, I. M. Neklyudov, O. A. Opalev, K. S. Rubtsov, V. F. Rybalko and A. M. Ternopol, Kharkov]

[Abstract] An experimental study was made concerning erosion of nickel, copper, and stainless steels Cr16Ni15Mo3Nb and Cr18Ni10Ti by H^+ ions in a negative-discharge hydrogen plasma. The plasma generator consisted of two cathodes at equal potentials, with water cooling, symmetrically mounted inside a vacuum chamber with walls made of stainless steels and acting as the anode. A magnetic field of up to 0.125 T intensity and parallel to the discharge column was applied by two coils symmetrically mounted on the chamber housing behind the cathodes. The chamber was evacuated by means of an ABED-3000 Ti-sorption pump to a pressure of 10^{-5} Pa, analysis in an IPDO-2 mass-spectrometer indicating H_2 as the principal component of the residual gas mixture with O_2 and N_2 concentrations at least one order of magnitude lower. The H_2 concentration was subsequently raised and varied over the 0.15-0.4 Pa range, while the cathode voltage was varied over the -0.7-(-1.6) kV range. Specimens of the target materials, mechanically polished and vacuum annealed 1.5 mm thick disks 27 mm in diameter, were held in the discharge column for 30,000 s, for bombardment of their surface to an ion dose of 10^{22} cm^{-2}, at a temperature not exceeding 100°C. The energy spectrum of bombarding ions was measured in an electrostatic analyzer, ions entering through a hole 1.5 mm in diameter in one of the cathodes. An evaluation of the data has yielded erosion coefficients of 0.4 for Ni, 0.8 for Cu, 0.15 for Cr16Ni15Mo3Nb steel and 0.08 for Cr18Ni10Ti steel at the peak of the ion energy spectrum. These values are one order of magnitude higher than those of the corresponding metal atomization coefficients obtained in other experiments with monoenergetic H_2-ion beams. This cannot be explained by presence of O^+ and N^+ ions in the residual gas, but most likely by self-atomization of a metal by its own ions generated in the process. References 7: 2 Russian, 5 Western.

2415/9835

UDC 669.872.5'75"536.421.4

Effect of Weightlessness and Effect of Magnetic Field on Liquation Processes in InSb Crystals

18420016 Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul-Aug 87 (manuscript received 27 Jan 87) pp 63-67

[Article by V. S. Zemskov and M.R. Raukhman, Moscow]

[Abstract] Two methods of growing InSb:Te single crystals are compared, the Czochralski method without rotation in a transverse or longitudinal magnetic field on earth and the Bridgman method in outer space. Experimental data on melting and solidification under each condition are evaluated on the basis of the Grashof model of hydrodynamics with heat convection but without forced mixing. The results reveal an analogy between the two methods and the possibility of attaining laminar flow so as to ensure purely diffusional mass transfer resulting in a high degree of microhomogeneity. References 13: 6 Russian, 7 Western (3 in Russian translation).

2415/9835

UDC 621.793.7

Modification of Flame-Sprayed Coatings by Laser Treatment

18420017b Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul-Aug 87 (manuscript received 17 Sep 86) pp 78-82

[Article by A. A. Uglov, A. D. Fomin, A. O. Naumkin, P. Yu. Pekshev, I. Yu. Smurov and M. B. Ignatyev, Moscow]

[Abstract] An experimental study of flame-sprayed coatings on steels and aluminum alloys was amde concerning control of their characteristics by laser treatment. Coatings of PG-SR4 self-fluxing powder alloy in the Ni-Cr-B-Si class, of ZrO_2 powder ceramic, and of Ti powder were deposited on St 45 steel and on AlMgCr605 aluminum alloy, some in atmospheric air and some under controllable reduced pressure, with UPU-2D equipment and with "Plasma Technique" equipment. They were then treated with a Kvant-15 industrial pulses YAG:Nd^{3+} laser operating in the free emission mode or with a "Spectra Physics" continuous-wave CO_2-laser. The results of such a treatment were evaluated by metallographic examination under an MIM-8 optical microscope, microstructural examination under a JSM-U3 scanning electron microscope with an x-ray microanalyzer, and phase analysis in a DRON-2.0 x-ray diffractometer. Microhardness was measured with a PMT-5 tester and porosity was measured with a picnometer. The results indicate that flame spraying combined with laser treatment improves the characteristics of the coatings. The heat-affected zone should not extend deeper than 1 mm below the coating and Ti coatings, approximately 100 μm thick, should preferably be nitrided during laser treatment by treatment in a nitrogen jet. References 4: 2 Russian, 2 Western.

2415/9835

UDC 537.312.62.001

Mechanism of Transition to Superconducting State Upon Nonlinear Excitations in Strongly Anharmonic Lattices

18420019a Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 64, No 2, Aug 87 (manuscript received 12 May 87) pp 288-293

[Article by Yu. A. Izyumov, V. M. Laptev and Yu. N. Skryabin, Metal Physics Institute, Ural Department, USSR Academy of Sciences]

[ABstract] Upon the discovery of high-temperature superconducting materials, specifically Cu-base ceramics, new mechanisms of electron pairing with attendant transition to the superconducting state have been sought. One such mechanism has been hypothetically found in crystals where electrons interact with strongly anharmonic lattice vibrations as well as with harmonic ones. The role of anharmonic vibrations can be analyzed on the basis of a model with two potential wells. This is done for a crystal containing metal atoms in a surrounding of groups of lighter atoms. The corresponding system of Eliashberg equations contains, accordingly, not only the ordinary electron-phonon interaction constant but also an electron-pseudospin interaction constant. Nonlinear excitations producing lattice anharmonicity can occur and give rise to superconductivity not only in quasi-one-dimensional structures but also in quasi-two-dimensional ones. References 5: 1 Russian, 4 Western (1 in Russian translation).

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Alloying Surface Layer of Structural Steels With Chromium From Cr Coating by Laser Treatment

18420017a Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul-Aug 87 (manuscript received 3 Dec 86) pp 74-77

[Article by I. Ye. Kurov, S. N. Nagornykh, G. A. Sivukhin, and S. V. Solenov, Gorkiy]

[Abstract] An experimental study was made concerning laser treatment of Cr-coated austenitic 12Cr18Ni10Ti and sorbitic 38CrNi3Mo structural steels for the purpose of building up the Cr content in the steel surface layer and thus increasing their corrosion resistance as well as hardness without producing significant macrodefects. With electrolytically deposited 50 μm thick Cr coatings, specimens of both steels were, after annealing, treated with a scanning continuous-wave CO_2-laser beam surrounded by a gaseous shield comprising an Ar + N_2 mixture under a moderate gage pressure. The power density was varied over the 10-30 kW/cm^2 range and the scan rate was varied over the 1-4 mm/min range. The results were evaluated on the basis of metallographic examination under an MIM-8 optical microscope; chemical and

phase analysis was performed in a "Gamebax" x-ray spectrum microanalyzer with a 0.5 μm space resolution, and microhardness measurement with a PMT-3 tester. The depth of chromium penetration into the steel surface layer was found to depend on both the velocity of the light spot and the power density within it, being almost equal to the case thickness in 12Cr18Ni10Ti steel and being equal to not more than half the case thickness in 38CrNi3Mo steel. The results fit the theory of convective hydrodynamic processes when phase transitions and changes of state, evaporation of chromium taking pr cedence over its sublimation are accounted for. References 9: all Russian.

2415/9835

UDC 621.793.621.91.621.315

Buildup and Some Characteristics of Cr and Cr-Ni Coatings Deposited on Diamond From Gaseous Phase

18420021 Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, Aug 87 (manuscript received 26 Nov 86) pp 52-56

[Article by Yu. V. Naydich, V. M. Chashnik, I. A. Lavrinenko, G. P. Volk, and O. A. Gnitetskiy, Institute of Materials Science Problems, UkSSR Academy of Sciences]

[Abstract] An experimental study of Cr and Cr-Ni coatings on diamonds was made for a determiantion of their protective and some electrophysical characteristics. Such coatings were deposited from powder metal on 0.5-carat single crystals with a (110) facet by the contact-reaction process. Their buildup thickness was varied over the 0.5-6 μm range by regulating the deposition temperature and time over the 1000-1100°C range and the 5-240 min range respectively. The buildup characteristics were determined on natural diamond with a Kalibr profilograph and their protective characteristics were determined on AS6 200/160 synthetic diamonds. The electrical resistivity was determined from resistance measurements by the voltage-current method. The protective characteristics were studied after oxidation in air in a muffle furnace heated to 900°C at a rate of 30-35°C/min. Chemical and x-ray phase analysis with data processing on a MERA-60 computer revealed Cr_3C_2 and Cr_7C_3 in Cr and Cr-Ni coatings before oxidation, also Cr_2O_3 in Cr and Cr-Ni coatings as well as NiO in Cr-Ni coatings after oxidation. The electrical resistance of all coatings was found to decrease to a nearly constant level with increasing thickness and to increase at an increasing rate with rising oxidation temperature but at a constant rate with oxidation time. References 15: 3 Russian, 2 Western (1 in Russian translation).

2415/9835

UDC 537.525.72:621.762

Deposition by High-Frequency Plasma in Fabrication of Fiber-Optic Blanks

18420006a Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 14 May 86) pp 40-45

[Article by L. M. Blinov, A. V. Obukhov, N. N. Rykalin (deceased), L. M. Sorokin and I. P. Shilov, Moscow]

[Abstract] Fabrication of single-mode optical fibers, namely deposition of SiO_2 sheath and $SiO_2 + GeO_2$ core layers inside a quartz housing tube by the high-frequency plasma technology, is analyzed on the basis of a correlation of electrodynamic theory of high-frequency pulse discharge with experimental results. The S/a ratio of SiO_2 sheath thickness to $SiO_2 + GeO_2$ core radius is regarded as the fundamental design and performance criterion, a large ratio ensuring small losses. The high-frequency plasma forms soot-like SiO_2 and $SiO_2 + GeO_2$ powders which, during passage through the tube, deposit on inside surfaces by thermophoresis. A tube is then imploded by heating with a gas burner for 4-5 h, during which much glass evaporates so that the extruded fiber may not reach its full length. Theoretical calculation of layer thickness attainable with a plasmatron and the necessary electric field intensity, on the basis of two applicable Maxwell equations, is supplemented with experimental data pertaining to typical 2.5 mm thick tubes 19 mm in diameter and including the radial temperature profile. The latter was determined on the basis of measurements by the absolute method in an ISP-51 spectrograph using the O I 4368 Å oxygen line. References 6: 2 Russian, 4 Western.

2415/9835

UDC 533.92:621.039.61

Inhibiting Evaporation of Irradiated Cr-Mn Steel by Plasma Deposition of Coatings

18420006b Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 23 Sep 86) pp 81-82

[Article by G. G. Bondarenko, V. V. Vasilyevskiy, G. V. Guskov and N. K. Shvedov, Moscow]

[Abstract] Protective coating of Cr12Mn14N14Al2Mo austenitic steel for inhibition of its intense evaporation during post-irradiation heating was tested on 0.5 mm thick strips. Such strips, 8 mm wide and 12 mm long with 0.05 μm thick or 0.7 μm thick Ti coating on their surfaces as well as bare ones, were bombarded with 80 keV helium ions to a dose of $6 \cdot 10^{17}$ cm^{-2} at room temperature in the "Vesuvius" accelerator. They were then soaked at a

temperature of 700°C under a vacuum of $5 \cdot 10^{-6}$ Pa, while their evaporation was monitored by weighing in oilless vacuum on a quartz microbalance sensitive to a loss of mass as small as $4 \cdot 10^{-7}$ g. Curves plotted on the basis of loss-of-mass readings and graphically describing the kinetics of the evaporation process, the evaporation rate as a function of time, indicate that Ti coatings are generally effective evaporation inhibitors under the given conditions. Coatings thinner than the projected path of bombarding ions in titanium are found to be more effective than coatings thicker than that path, while thicker coatings are more effective on steel which has not bee irradiated prior to heating. References 3: all Russian.

2415/9835

UDC 669.018.95

Role of ZrC Coating in Stabilization of Fiber-Matrix Interface in Cr-Base Composite

18420007 Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 21 Oct 86) pp 108-113

[Article by D. M. Karpinos, V. N. Balakhina, S. P. Listovnichaya and V. B. Boytovich, Kiev]

[Abstract] An experiment with a composite material consisting of a Cr matrix and ZrC-coated reinforcing W fibers was performed, for a study of the interaction of phases in contact at both the coating-fiber and coating-matrix interfaces. Specimens of this material were produced from electrolytic Cr powder and W wires 100 μm in diameter with 15-40 μm thick protective ZrC coating. The compatibility of these structural components was monitored under an electron microscope and under an optical one, as well as on the basis of x-ray spectral microanalysis and x-ray phase analysis, before and after annealing at a temperature of 1573 K for up to 100 h under a vacuum of $13.3 \cdot 10^{-3}$ Pa. On the basis of their phase composition, fibers could be classified into two groups: monophase ones with continuous pure ZrC coating and polyphase ones with ZrO_2, ZrO_xC_y compounds, and free C also present in the coating. The compatibility of continuous ZrC coating with the Cr matrix was found to be limited, the life of such a coating at 1573 K being only 100-150 h long. Mass transfer across both interfaces was found to depend on both stoichiometry and phase composition of the coating, and to proceed in three stages: 1. a latent stage characterized by saturation of the coating with Cr and W but also a nonmonotonic distribution of Cr across its thickness; 2. a diffusion stage with penetration of Cr into W fibers accompanied by formation of a continuous series of solid solutions and with the Cr concentration decreasing monotonically toward the fiber axis; 3. a segregation stage with two separate continuous series of solid solutions and with Cr concentrated on the inside surface of the coating as well as on the W substrate. The results reveal that the inequality of the rates at which Cr and W diffuse in opposite directions gives rise to a Kirkendall effect. References 8: 7 Russian, 1 Western.

2415/9835

UDC 548.736.442.6:537.312.62

Superconductor Properties of $RBa_2Cu_3O_{7+y}$ Compounds With Rare-Earth Element R

18420019e Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 64, No 2, Aug 87 (manuscript received 12 May 87) pp 338-342

[Article by Ya. N. Blinovskov, I. A. Leonidov, V. L. Kozhevnikov, S. M. Cheshnitskiy, S. A. Davydov, A. Ye. Karkin, A. V. Mirmelshteyn, A. A. Fotiyev and B. N. Goshchitskiy, Metal Physics Institute, Ural Department, USSR Academy of Sciences]

[Abstract] Ceramic compounds $RBa_2Cu_3O_{7+y}$ (R = Y,Nd,Sm,Eu,Gd,Ho,Er,Tm,Yb,Lu) were synthesized experimentally, the purpose being to establish the condition necessary for their becoming superconductors. Specimens of each compounds were produced from stoichiometric mixtures of oxides CuO and R_2O_3 with $BaCO_3$, the reaction beginning at a temperature about 900°C with attendant escape of CO_2. They were first annealed for 40 h at 920-940°C in air (p_{O_2} = 0.21 atm) so as to prevent loss of oxide which would occur at higher temperatures owing to dissociation of left-over CuO, new material being added in 10 h intervals. They were then molded under a pressure of 500 MPa and again annealed, this time at 900°C for 10 h in oxygen (p_{O_2} = 1-2 atm), cooled to 400°C at a rate of 1°C/min, held at that temperature for 5-6 h, and cooled in furnace to room temperature. The temperature range of superconducting transition and its center point T_c were determined on the basis of measurements by the inductance method and by the resistance method, each yielding somewhat different temperatures at which 95% of the compound had become superconducting, in a magnetic field of up to 6 T intensity. Phase composition depending on the oxygen pressure during synthesis was determined in an x-ray diffractometer with CuK_α-radiation, all compounds having been found to crystallize into the orthorhombic system. The results indicate that all compounds synthesized at properttemperature and under proper oxygen pressure will become superconductors within approximately the same transition range up to about 90 K and with an upper critical magnetic field intensity of 1.5-2 T/K. References 3: all Western.

2415/9835

UDC 669.25'871:535.331.34

Optical Properties of Co-Ga Intermetallic Compounds in Infrared Region of Spectrum

18420019c Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 64, No 2, Aug 87 (manuscript received 3 Apr 86, in final version 23 Dec 86) pp 313-317

[Article by L. V. Nomerovannaya and N. A. Popova, Metal Physics Institute, Ural Department, USSR Academy of Sciences]

[Abstract] An experimental study of eight Co_xGa_{100-x} compounds with the atom.% Co varied over the x = 0.466-0.62 range was made for a determination of their optical properties in the 0.07-1.0 eV infrared energy range, at room temperature, these properties relating to plasma and relaxation frequencies of the conduction electrons as well as to both real and imaginary parts of the complex dielectric permittivity. Phase analysis of these compounds confirmed their crystallization into a CsCl lattice as a result of a peritectic reaction at approximately 1200°C. Refractive index and absorption coefficient were measured by the Beatty polarization method on specimens with specular surface finish which had been produced by grinding and subsequent electrolytic polishing with a 6% HCl solution in CH_3COOH at room temperature and a current density of 0.8-1.0 A/cm^2. An evaluation of the results reveals a lowering of the plasma frequency and a corresponding decrease of the static electrical conductivity as the Co content increases. This is explained by a high degree of structural disorder, defectiveness of crystals, and a sharply peaking density of states in the band structure, all of which cause redistribution of the electron spectrum near the Fermi level. The authors thank N. B. Gorina for supplying specimens and G. A. Bolotin, M. I. Katsnelson, and M. M. Kirilova for discussion and helpful comments. References 11: 1 Russian, 10 Western (1 in Russian translation).

2415/9835

UDC 537.311.33

Micrononuniformity of Electrical Resistivity of Silicon Doped With Neutrons

18420004a Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: NEORGANICHESKIYE MATERIALY in Russian Vol 23, No 7, Jul 87 (manuscript received 2 Aug 85) pp 1065-1068

[Article by Ye. S. Yurova, V. V. Fedorov, M. A. Morokhovets, O. M. Grebennikova, I. N. Voronov and A. A. Stuk, State Scientific Research and Design Institute of the Rare Metals Industry]

[Abstract] An experimental study of Si single crystals doped with neutrons was made for the purpose of determining the dependence of the resulting

micrononuniformity of their electrical resistivity on their structure, conductivity type, and original electrical resistivity. Two groups of specimens were produced and tested, all approximately 5 mm thick slabs cut from single crystal grown by the floating-zone method. The specimens of one group, n-type and p-type specimens with the mean electrical resistivity ranging from 100 ohm·cm to 30,000 ohm·cm and its mean micrononuniformity ranging from 5% to 60%, were cut from 43 different single crystals and all doped with thermal neutrons of the same flux intensity to a mean electrical resistivity of 180 ohm·cm, and then annealed. The specimens of the second group were all cut from the same n-type single crystal, with an original mean electrical resistivity of 1000 ohm·cm, after it had been doped with thermal neutrons of the same flux intensity as the others to a mean electrical resistivity of 180 ohm·cm and then similarly annealed. Local electrical resistivity was measured in 100 μm steps by the current-voltage method with an "ASR-100" instrument having a resolution of 10 μm and a sensitivity of 1.5%. Microstructural examination revealed pipe defects in all specimens, in those originally defective as well as in those originally nondefective. The results of theoretical calculations (separate for originally defective and originally nondefective specimens, based on the nonhomogeneity of original material) on the increment of electron concentration as a result of doping, on the electron mobility and, in the case of p-type specimens, on the ratio of electron mobility to hole mobility agree closely enough with the experimental data if allowance is made for technological variance owing to surface contamination and depthwise diffusion of contaminants during neutron and heat treatment. Pipe defects are found not to influence the micrononuniformity of the electrical resistivity either before or after doping with neutrons and, moreover, p-type Si is found to remain highly homogeneous after heavy doping with neutrons. The authors thank L. V. Layner for participation in the study and discussion of the results. References 4: 3 Russian, 1 Western.

2415/9835

UDC 546.48

Production of CdP_2-$CdAs_2$ Solid-Solution Single Crystals and Measurement of Their Cathodoluminescence Spectra

18420004b Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: NEORGANICHESKIYE MATERIALY in Russian Vol 23, No 7, Jul 87 (manuscript received 2 Sep 85) pp 1086-1089

[Article by V. B. Lazarev, S. F. Marenkin, K. Khakimov and M. V. Chukichev, General and Inorganic Chemistry Institute imeni N. S. Kurnakov, USSR Academy of Sciences]

[Abstract] Single crystals of a CdP_2-$CdAs_2$ solid solution were produced, for cathodoluminescence measurements, from a mixture of fine-disperse CdP_2 and $CdAs_2$ powders in a 9:1 ratio by their fusion in a graphitized quartz crucible under a pressure of $1.3 \cdot 10^{-3}$ Pa into a polycrystalline $Cd(P_{0,9}As_{0,1})_2$

substance. The latter was cast into a steel mold for subsequent isothermal heat treatment in the vertical compartment of an SShOL-1 furnace at a temperature of 870 K for 48 h, after which the temperature was raised to 1058 K prior to vacuum sublimation of 80 h in a bizonal furnace with the temperature of the crucible being 870 K at the "hot" and 850 K at the "cold" end. The single crystals grown by this process, 6 mm long bars 3x2 mm^2 in cross-section, were examined in a "Camebax" electronic microanalyzer and an x-ray phase analyzer, which revealed tetragonal crystals with a $Cd(P_{0,9}As_{0,1})_2$ composition. Cathodoluminescence was excited by means of a 40 keV electron beam with a current density of 0.5 A/cm^2 and a mean current of 2 μA, in pulses of 0.5 μs duration at a repetition rate of 200 Hz. The cathodoluminescence spectra at temperatures covering the 4.2-300 K range were recorded in a DFS-12 spectrophotometer with a linear dispersion of 10 Å/mm over the 7800-11,000 Å range of wavelengths, auxiliary equipment including an FEU-61 photomultiplier, a wideband amplifier, a synchronous detector, and a KSP-4 recording potentiometer. The readings reveal an intensity peak which decreases and widens while it shifts from the 8543 Å wavelength to the 9400 Å wavelength as the temperature is raised from 4.2 K to 296 K. They also reveal a linear increase of the luminescence intensity at the peak wavelength as the mean excitation current is increased up to 6 μA. The temperature dependence of the energy gap has been determined according to the Varshni relation, upon insertion of numerical values for the two parameters in this relation on an empirical basis. The results indicate that transitions from donor level to valence band are the most likely mechanism by which recombination of charge carriers occurs here. References 3: 2 Russian, 1 Western.

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UDC 54-165

Doping Single Crystals of $Bi_2Te_{2.85}Se_{0.15}$ Solid Solution With Indium

18420004c Moscow IZVESTIYA AKADEMII NAUK SSSR: NEORGANICHESKIYE MATERIALY in Russian Vol 23, No 7, Jul 87 (manuscript received 12 Sep 85) pp 1128-1131

[Article by T. Ye. Svechnikova, S. N. Chizhevskaya and N. V. Polikarpova, Institute of Metallurgy imeni A. A. Baykov, USSR Academy of Sciences]

[Abstract] Single crystals of $Bi_2Te_{2.85}Se_{0.15}$ solid solution were grown by the Czochralski method from the liquid phase in an atmosphere of extra-pure helium while being doped with In_2Te_3, this method not only ensuring longitudinal and transverse homogeneity but also facilitating determination of dopant distribution factors. The solid solution had been produced by mixing Bi_2Te_3, Bi_2Se_3, In_2Te_3 powders in the appropriate ratio and fusing the mixture under a pressure of 0.1 Pa, iodine in the form of the SbI_3 compound being added so as to ensure n-type conductivity and In_2Te_3 being added in amounts of 0.2-5 mol.%. The crystals were sliced by electric-spark cutting for chemical analysis and electrophysical measurements. The In-content in the

powder mixture and in the melt as well as in the single crystals was measured by the atomic-absorption method in a Perkin-Elmer 303 spectrophotometer. An increase of the In concentration was found to lower the electron mobility and consequently also the electrical conductivity. An evaluation of the data has yielded an In distribution factor of approximately 0,5. References 12: 9 Russian, 3 Western.

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UDC 621.762.224

Apparatus for Producing Metal Powders by Centrifugal-Hydraulic Method

18420022a Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, Aug 87 (manuscript received 1 Oct 86) pp 1-3

[Articlebby Sh. M. Sheykhaliyev, V. V. Kuzmin and Ye. V. Luzmin, Department II, Moscow Engineering Physics Institute]

[Abstract] An apparatus has been designed and built for producing powders of nonferrous metals and alloys by centrifugal-hydraulic atomization of a melt, its atomization being limited to metals and alloys with a melting point not higher than 1273 K. The equipment includes a melting furnace with a controllable electric heater, a crucible with 10 l capacity, and a fixture holding one centrifugal atomizing nozzle, or three of them, with an additional heater. The fixture and the nozzle or nozzles as well as the crucible are made of stainless steel or graphite. Melt flows from the crucible down through the nozzle or nozzles into a water-cooled atomization chamber, from which powder drops into a collector. Temperature is controlled by means of Chromel-Alumel thermocouples and a DSP-4 potentiometer. Pressure is controlled by means of a manometer and an oil pump. Vacuum is controlled by means of a vacuumeter and a vacuum pump. The apparatus was tested in producing Sn-1 tin powder, P-Sn/Pb-61 powder solder, and an aluminum powder alloy, all with excellent fluidity and low impurity oxide content. The apparatus is economical and does not pollute the air. References 2: both Russian.

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UDC 621.762:669.017

Changes in Structure of Ultrafine-Disperse Tungsten Powder During Heating

18420022b Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, Aug 87
(manuscript received 9 Jul 86) pp 13-16

[Article by V. V. Skorokhod, V. V. Panichkina, G. S. Oleynik and V. I. Novikov, Institute of Materials Science Problems, UkSSR Academy of Sciences]

[Abstract] An experimental study of ultrafine-disperse tungsten powder was made for a determination of its structure during heating up to 1100°C. Specimens of such a powder were produced by electrical heating and vaporization of lumps in an argon atmosphere under low pressure. They were then annealed in a hydrogen atmosphere at several temperatures from 300°C to 1100°C for 30 min at each, while their specific surface and loss of mass were measured. Their morphology and microstructure at each temperature were examined under an "NI-200F" polarization electron microscope. Phase analysis was performed by the x-ray diffraction method. The results reveal a powder consisting at room temperature of a β-W phase and metallic W with a b.c.c. lattice, the former vanishing and the latter remaining at room temperatures above 600°C. Measurement of the grain growth has yielded a final radius of 100-250 nm, while theoretical calculations based on the equation of coalescence kinetics following surface diffusion yield a final radius of 50-100 nm. This difference can be reconciled by accounting for a contact area only half as large as the grain cross-section. References 6: 1 Russian, 5 Western.

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UDC 621.762

Dependence of High-Temperature High-Pressure TiC Compaction Process on Dispersity of TiC Powder

18420022c Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, Aug 87
(manuscript received 5 May 86) pp 31-35

[Article by L. F. Stasyuk and V. S. Neshpor, Superhard Materials Institute, UkSSR Academy of Sciences]

[Abstract] Compaction and sintering of TiC powders under pressures of 2.5-7.0 GPa and at temperatures up to 1800°C was studied in an experiment with preliminary comminution of the powder for a determination of its effect on the process and on the product quality. Powder was ground down by steel balls in a vibratory mill, which did not substantially change the chemical composition of the powder but added some Fe impurity. Sintering was done in a "Toroid" high-pressure apparatus at constant temperature for 16 min. Microhardness of the product was measured in a PMT-3 tester with a 50 g load and its density was measured by hydrostatic weighing. The microhardness

was found to increase with higher compaction pressure and with higher sintering temperature. A nonporous product was obtained by compaction under 7.0 GPa and sintering at 1800°C. Microstructural examination was done in a DRON-3 x-ray diffractometer with CuK_{α}-radiation. Fractograms were obtained and x-ray spectral microanalysis was performed under a "Camebax" scanning electron microscope with a microprobe attachment. The results indicate that precomminution of TiC powder does not significantly improve activation of the sintering process but contaminates the grain boundaries and thus weakens the coherence of intergranular bonds. References 6: all Russian.

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UDC 621.793

Production of Oxide-Metal Powder Composite Materials by Plasma Pulse Heating

18420022d Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, Aug 87 (manuscript received 10 Jul 85) pp 48-52

[Article by Yu. A. Pavlov (deceased), I. V. Blinkov, A. V. Manukhin and A. O. Ostapovich, Moscow Steel and Alloy Institute]

[Abstract] Metallization of Al_2O_3 powder with Ni by pulse heating with high-energy plasma was tried experimentally, such pulses of 100 μs duration being generated by high-voltage capacitor discharge. The low thermal conductivity of Al_2O_3, causing the heat to spread over the surface so that only a thin surface layer would melt and evaporate without any phase transformation occurring underneath was taken into consideration. Mixtures of α-Al_2O_3 + 20 wt.% Ni powders of various grain size fractions were fed into the 10 kV discharge gap, grains of α-Al_2O_3 having been segregated into $5 \cdot 10\text{-}6$ - $2 \cdot 10^{-5}$ m fractions and grains of carbonyl Ni having been segregated into 10^{-6} - 10^{-4} m fractions. Subsequent product evaluation has revealed that the bulk mass of such a composite powder increases while its specific surface and fluidity decrease with increasing plasma treatment time and thus with increasing number of heat pulses. Microstructural examination of grains with metal in cross-section by the x-ray method revealed a homogeneous coating of uniform thickness. References 7: all Russian.

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UDC 669.15'24:535.211;539.371

Effect of Laser Radiation on Phase Composition and Shape Memory of Fe-Ni Alloys

1842008a Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 19 Dec 86) pp 11-13

[Article by V. A. Bychkov, P. L. Gruzin and Yu. V. Petrikin, Moscow]

[Abstract] An experimental study of the Fe - 28% Ni - 5% Mo alloy has established the feasibility of controlling its phase composition and shape memory by means of laser treatment. Ingots of this alloy were produced by smelting carbonyl iron with electrolytic nickel and molybdenum in an MIFI-9 electric-arc furnace with an argon atmosphere. They were homogenized by annealing at a temperature of 1100°C for 50-100 h under a vacuum of 10^{-5} torr, then hot forged four times with intermediate surface cleaning by means of a 20% H_2SO_4 + 10% HCl + 70% H_2O etchant at a temperature of 70°C, then hot rolled into approximately 1-2 mm thick strips, and then rolled further into approximately 100 μm thick wafers in several passes with intermediate annealing. Chemical analysis yielded a C,Si,P content not exceeding 0.01 wt.%. Shape memory was imparted to the wafers by bending at liquid-nitrogen temperature. They were then nonuniformly heated by radiation of the λ = 1.06 μm wavelength from a Nd-laser in pulses of 100 ns duration and up to 4 J/cm^2 energy density. Their phase composition and distribution were determined with the aid of nuclear-gamma-resonance spectroscopy with recording of conversion electrons and with removal of successive surface layers. The results indicate hardening by laser radiation with an attendant increase of the martensite content in an up to 30 μm thick surface layer. Laser treatment was also found to change the magnitude of the shape memory effect, to increase it by a factor of up to 1.5 on the side under compression by increasing the nonhomogeneity and to decrease it by a factor of up to 2.0 on the side under tension with the highest martensite content by inducing martensite--austenite transformation and thus reducing the nonhomogeneity. References 4: 3 Russian, 1 Western.

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UDC 669.8715'775.539.1.043

Formation of Defects in GaAs Upon Nuclear Doping

18420008b Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 9 Sep 86) pp 28-33

[Article by N. G. Kolin, V. T. Bublik, V. B. Osvenskiy and N. I. Yarmolyuk, Moscow]

[Abstract] The buildup and behavior of point defects in GaAs upon implantation of predominantly thermal neutrons as well as their curing by heat treatment were studied in an experiment involving precise measurement of the material density and the lattice period. Single crystals of n-GaS with an electron concentration of $(1-5)\cdot10^{16}$ cm^{-3} and an electron mobility of 4000-5000 $cm^2/(V\cdot s)$ were grown by the method of horizontal pulling. They were bombarded with thermal neutrons and fast neutrons in an approximately 10:1 ratio, the flux intensity of thermal neutrons being $5\cdot10^{13}$ $cm^{-2}s^{-1}$, in vertical channels of a VVR-Ts water-moderated water-cooled reactor at a temperature of 70°C. Nuclear (n,γ)-reaction produced Ge and Se donors, their concentrations in the single crystals being measured on the basis of chemical-spectral analysis and found to vary over the $5\cdot10^{17}$-$5\cdot10^{18}$ cm^{-3} range. The lattice period was measured by the Bond method, accurately within $\pm(1-2)\cdot10^{-5}$ Å, using radiation from a $CuK_{\alpha1}$-source and fourth-order reflection by the (111) plane. The density was measured by the method of hydrostatic weighing, accurately within $\pm2\cdot10^{-5}$ g/cm^3. These measurements have yielded the dependence of the lattice period increment and of the density on the total neutron dose, over the $3.5\cdot10^{18}$ - $3.5\cdot10^{19}$ cm^{-2} range, on the basis of which the dependence of the differential defect concentration on the neutron dose could also be established by calculation. After bombardment to various neutron doses, GaAs single crystals were annealed at temperature ranging from below 200°C to 600°C. The lattice period and the density were measured again, to establish their dependence as well as that of the differential defect concentration on the annealing temperature. The results indicate that neutron bombardment produces Frenkel pairs, which is confirmed by the close agreement with theoretical calculations of the density and the lattice period on this basis. While low-temperature annealing is found to be ineffective, high-temperature annealing is found to cure the radiative interstitial defects. References 10: 9 Russian, 1 Western.

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UDC 535.68

Dependence of Optical Properties of Metal Surfaces on Physical and Chemical State of Surface Layer

18420008c Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 3, May-Jun 87 (manuscript received 23 Dec 85) pp 93-96

[Article by I. M. Korzhenevich, O. N. Melnikov and Yu. F. Nazarov, Moscow]

[Abstract] An experimental study of three aluminum alloys and two titanium alloys was made for an evaluation of their surface treatment on the basis of optical measurements. The premise being that free electrons in a metal influence the defectiveness and the work function characterizing respectively the physical state and the chemical state of the surface layer. Flat rolled specimens of AlMg-6, AlMg-3, AlCu-1 and WTi-6, WTi-14 alloys were turned or milled with hard-alloy and diamond cutting tools and also blasted with free abrasive particles in a water stream. The titanium alloys were also oxidized by heating in air for various lengths of time. The optical properties of the surfaces as well as their work function were measured during each treatment. Their integral absorptivity over the 0.1-2.5 μm range of radiation wavelengths was measured with FM-59 and FM-85 photometers. Their integral emissivity over the 4-40 μm range of radiation wavelengths was measured with TIS and TERM-1 thermal radiometers. An evaluation of the data, integral absorptivity and emissivity being related to spectral monochromatic emissivity according to Planck's law with the sun's temperature as reference, indicates that the crystalline structure of the surface layer is differently distorted by different surface treatment. The differences are appreciable, also relative to a polished surface, but the difference between effects of treatment on the surfaces of various alloys within the same class ranges from slight to negligible. Heating with oxidation of titanium alloys was found to saturate their absorptivity and emissivity after only 7 min, while dropping their work function into the negative range after 4 min already, regardless of the mode of prior mechanical surface treatment. The results, formulated into a mathematical model, provide a basis for optimization of surface treatment. References 2: 1 Russian, 1 Western (in Russian translation).

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Conditions for Strong Bonding During Sputter Welding of Powders to Solid Metals

18420018 Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul-Aug 87 (manuscript received 19 Dec 86) pp 108-113

[Article by A. M. Kaunov, Volgograd]

[Abstract] Experimental study of sputter welding as a method of powder coating surfaces of solid metals and theoretical study of the powder melting and bonding processes under an obliquely incident shock wave have revealed how much activation energy and what temperature of the substrate-powder interface will ensure strong bonding of Cu, Ni, Fe, Mo, Ti powders to solid iron and Fe, Ni powders to solid copper, as well as how much that temperature will rise in the process. Calculations made on a YeS-1020 computer, to aid thermodynamical and stress analysis on the basis of equations of energy balance and process kinetics, indicate that the surface temperature of an iron base should be from 568 K for Cu powder to 1826 K for Ti powder and the surface temperature of a copper base whould be from 1115 K for Fe powder to 1170 K for Ti powder. The additional temperature rise in the process will vary within the $(0.35-0.7)T_m$ range, where T_m denotes the melting point of the powder material. References 14: 13 Russian, 1 Western (in Russian translation).

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Mistakes in Organization of Construction in Yakut ASSR Discussed

1842003 Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 26 Aug 87 p 2

[Article under the "Our Reporter Dictates Directly to This Issue" rubric "Alarm in the Radius of Operations"]

[Text] The fanfare sounds on the occasion of the Neryungrinskiy open pit reaching its design capacity and the commissioning of the concentrating mill and the GRES [State district electric power plant] have ceased. Indeed, the enterprises are impressive in their power. But let us not kid ourselves: at the first territorial-production complex [TPC] in the BAM [Baikal-Amur railroad] zone, only the coal mining industry is operational. Could it be that planning bodies have miscalculated and that there is no basis for the complex?

Of course, the basis is there. They do not call the Southern Yakutiya the BAM pearl for nothing. The bowels of the earth here are rich with copper, molybdenum, apatites, mica, coking coal and iron ore.

For instance, the iron ore deposits in the Charo-Tokinskiy region are not inferior to those of the Krivoy Rog Basin and the Krusk Magnetic Anomaly, and in some qualitative indices they are superior to those. According to estimates, the Tarynnakhskaya area is the largest in the eastern part of the country. Here, a combine can be created that would produce 26 million tons of ore and 7 million tons of magnetite concentrate annually. In the Yuzhno-Aldanskiy iron ore region, reserves in three of its deposits alone, the Tayezhnoye, Desovskoe and Pionerskoye, can support the production of 9-10 million tons of metal a year.

But...it is still not known, where the metallurgical combine will be located. Earlier studies oriented it toward the Amur Oblast, namely toward the Garinskoye deposit, discovered in the fifties. However, as far as reserves of ore, coking coal, refractory materials and fluxes are concerned, this region cannot compete with Southern Yakutiya. It would seem that the situation is clear, but the final solution is still far away. Preparatory work at the Seligdarskiy apatite plant, mentioned in the Basic directions for the development of the USSR national economy, is also slow. And the prospects for the principal industry, coal mining, are a cause for alarm. Here is what the secretary of the Neryungrinskiy CPSU city committee A. Deryabin thinks:

"During the current Five-Year Plan, about 15 million tons of coal will be produced in our open pit. At this rate of mining, the deposit will be depleted by the year 2010. What would then be the fate of the town and its working collectives? Further production of coke concentrate and the operation of the GRES and the country's largest concentrating mill will depend on commissioning the Denisovskoye and Chulmakanskoye deposits that contain around one billion tons of high-quality coking coal. But this coal can only be produced by shaft mining. One should build the shaft mines today: tomorrow it will be late".

Indeed, in order to keep the concentrating mill 100% busy, it is necessary to commission three shaft mines, each with 3-4 million tons capacity, by the year 2010. There is barely enough time for the consecutive commissioning of these mines, as it usually takes six to ten years to build one. But Minugleprom [Ministry of Coal Industry] has not provided for designing even the first one, the "Denisovskaya" mine, in the 12th Five-Year Plan. Such planning policy will inevitably result in having to construct all three mines at the same time. One can know ahead of time what is in store: rush work and overexpenditure of capital investment.

Alas, this is not the only example of staff short-sightedness. While the Yuzhno-Yakutskiy TPC was being formed, the 15,000-employees collective of the Yakutuglestroy combine had gotten strong. It is capable of performing construction and installation work at the annual rate of 150-200 million R.

But its forces are being split, its subdivisions are being sent to various corners of the country. This year, Minugleprom forced the Yakutians to build production facilities at the KATEK [Kuybyshev Automobile and Tractor Electrical Equipment and Carburetor Plant], the Raspadskaya concentrating mill in the Kuzbass [Kuznets Basin], apartment buildings in Kharanor, Chita oblast, the Urgalskaya shaft mine in Khabarovsk Kray, etc. Its radius of operations is 1,500 to 4,000 km. Is this a businesslike approach? Let's judge: often, reinforced concrete and construction parts are delivered to "outside" objects from...Neryungri. A component, which is made in Yakutiya from imported cement and reinforcement and just because of this is twice as expensive as the same component made at the KATEK, is being shipped 3,500 km. Where to? To KATEK. Is there any logic in this bureaucratic thinking?

"It hurts to see what is going on", the combine Party committee secretary V. Kravchenko is outraged. "Our collective has been created with the future in mind. There is plenty of work in Yakutiya. The setting-up of just two deposits, the Denisovskoye and Chulmakanskoye, would keep us consistently busy for a long time. Next is devleopment of the shaft mines at Dzhebariki-Khay, with protected reserves of 300 million tons and predicted reserves exceeding two billion tons. If worst comes to worst, our capacity could also be used in construction of metallurgical enterprises. Our combine is the largest in the Eastern part of the country, and if one is speaking of integrated and accelerated development of the Far Eastern region, we should be working here, and here only".

The "out-of-town" model not only results in material losses, but it also tremendously damages morale. Minugleprom has approved a system, wherein Yakutuglestroy employees, who are sent to, say, KATEK, are guaranteed 50% of their previous wages (350 R on the average). Even doing nothing, a Yakutian in Kansk is paid more than a local worker is paid for shock work. Naturally, tense relations develop between the two. Such system breeds sharp discontent, as far as labor organization is concerned, in some people and a habit of slipshod work in others.

"Outside" objects undermine the foundation of the financial well-being of the combine. Due to confusion in plan calculations, Minugleprom raised the per capita output for the Yakut mine construction workers too high, having forgotten that 1 R at KATEK is equal to 2.5 R in Neryungri. And non-fulfillment of labor productivity automatically resulted in a sharp reduction of material incentive and social development funds.

The Northerners took up this problem with the Deputy USSR Minister of the Coal Industry A. Pshenichnyy, with the Ministry Party secretary V. Komarov and the Soyuzstroytek association. The response is always the same: "You've got the plan - go ahead and fulfill it".

V. Kravchenko says: "The problem is that the Ministry is viewing Yakutuglestroy as a reserve for work at other construction sites. But an acute social problem is ripening here, and it already manifests itself in sharply increased employee turnover and disintegration of collectives".

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30 March 1988